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Nevertheless I hope in a few years' time to be able to extend this investigation a little further, and to open up one or two fresh lines of research in this psychologically interesting field.

Anomalous Occultations of Stars by the Moon. By R. T. A. Innes.

It is well known that on several occasions double stars have been discovered through the phenomena attending their occultation by the moon.

Cases in point are the discovery by Professor Barnard in 1883 of the duplicity of Bradley 2607, the star which is closely preceding β *Capricorni*, and the discovery by Burg of Vienna in 1819 that *Antares* is a double star.

Another remarkable instance, but not so well known, is that of P. XVI. 68. On 1836 September 16 Sir Thomas Maclear, using a 3-inch telescope, observed the occultation of this star, and remarked that the star "disappeared gradually."

Fifty-three years later Burnham, with the 36-inch Lick refractor, found this to be a double star (β 1115).

In my own experience unusual occultations of many stars have been observed, and some of these were afterwards found to be known pairs, viz.

BD. $-22°$, 3908.	"Glided out, took $0^{\cdot}5^s$ to disappear." This is β 809, mags. 8·6 and 10·2, distance 1·6″.
P. XIII. 126.	"Began to fade at $25^{\cdot}7^s$, disappeared at $28^{\cdot}0^s$, good." This is β 932, 0·44″.

The slow progression of the moon amongst the stars (about 0·55″ in one second of time) and the sharp character of a good disappearance at the dark limb should similarly disclose the presence of double stars of exceeding closeness, or of stars having a measurable diameter. The greater number of dark-limb occultations are seemingly instantaneous; the exceptions are of two classes:

(A) The star disappears in two distinct stages.

(B) The star disappears gradually, or glides.

When a star disappears in two distinct stages, there is a high presumption that it is really a double star; and at first sight it would appear that the phenomena of "gliding" occurs when a star has a disc of such a size that it is not instantaneously obliterated by the advancing moon. But "gliding" is actually found to occur with double stars, as is shown in the cases of β 809, β 932, and β 1115 quoted above. It may there-

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fore be that the difference between "disappearing in two stages" and "gliding" is due to physiological causes. The examples just referred to show that in one case I failed to discriminate between a disappearance in two stages, half a second apart (which is what must actually have occurred) and a "glide"; in the other case the two stages took $2{\cdot}3^s$, and yet they were not seen distinctly, as the word "fade" was adopted. Thus it remains doubtful if there is any real distinction between a star disappearing behind the moon's limb in two stages or in "gliding." If a star has an appreciable diameter it will appear to go out gradually, if the whole time occupied in completing its obscuration is upwards of about $\frac{1}{10}$th of a second. The limit of persistency of retinal impressions is given as from only $\frac{1}{50}$th to $\frac{1}{30}$th of a second—a determination based, I believe, on experiments with electric sparks. In the case of stars it is probable that the limit is longer—perhaps $\frac{1}{10}$th of a second—as has just been assumed. If a star of the ninth magnitude disappears behind the so-called dark limb when the moon is three or four days old, the phenomenon is seldom seen as a sudden one. This may be attributed to the lack of contrast between the star and the strongly illuminated dark limb of the moon, so that the star is only glimpsed by special effort—an effort that cannot be continuously maintained—the interruptions of vision lasting perhaps $\frac{1}{5}$th of a second. If *Sirius* has a real diameter of $0{\cdot}01''$ its complete occultation would occur in $0{\cdot}02^s$, which would certainly be called "instantaneous." This assumes that the occultation is central. If it occurs at an angle θ from the direction of the moon's path, the time would be

$$\frac{0{\cdot}02^s}{\cos\theta};$$

and this only amounts to $0{\cdot}1^s$ for the few occultations (1 in 50), where θ is greater than 78°. When θ becomes greater, irregularities of the moon's limb nullify a rigorous application of the formula. It is not probable that any star in the zodiac or elsewhere exceeds *Sirius* in apparent diameter, but it is not impossible. Sometimes, when searching for double stars, one comes across a solitary star which refuses to exhibit the satisfactory hard disc of a single star, but which has not the characteristics of a close double star; there is just a chance that in these rare cases an appreciable disc is really seen. Again, planetary and gaseous nebulæ vary in size from measurable diameters to 1″ or less, and they no doubt exist in increasing numbers as they become smaller. The star *Lalande* 20204 is really a planetary nebula, but it has often been observed as a star. Another planetary nebula is C.P.D. −45°, 7306, and is according to Sir J. Herschel "perfectly sharp, 4″ in diameter." It is, however, unlikely that there are many unrecorded nebulæ in the guise of bright stars, as gaseous nebulæ are so easily discovered with the spectroscope.

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It would thus appear that both the phenomena of disappearing in two stages and of gliding are almost certainly due to the star being really a binary system, but not incontestably so. It is necessary to add that "gliding" is not due to an unsteady atmosphere, as I have frequently secured instantaneous occultations with the very worst definition.

This paper owes its origin to the vivid impression made on my mind when the occultation of *o Tauri* was observed some nights ago (February 26) with the 7-inch Merz refractor of the Cape Observatory. The star disappeared in two equal parts separated by about $0{\cdot}2^{\mathrm{s}}$. The phenomenon was so distinct that I feel quite sure that this star is double. It is difficult to be exact as to the interval of time, which might easily be greater or less than $0{\cdot}2^{\mathrm{s}}$. If it is approximately correct, and the position angle of the double star happens to be parallel to the moon's path, the distance would be about $0{\cdot}1''$. A somewhat similar case with the star τ_1 *Arietis,* wherein two observers at separate stations took part, is recorded in the *B. A. A. Journal,* vol. iii. p. 187.

In the recent lists of Cape occultations published by Sir David Gill many anomalous occultations are recorded; some of the more noticeable which I have observed are :

o Tauri.	As mentioned above.
θ Cancri.	"Disappeared in two stages 0·2 sec. apart as though double, not glided" (1898 April 28).
BD. 15°, 1975.	Mag. 8·0, not so faint as given in B.D., "glided, taking quite 1 sec. to disappear" (1898 May 26).
P. XIV. 212.	A well-known double star with considerable parallax and proper motion. (See *Cape Annals,* vol. viii. p. 105, B.) "The pr. and fainter star glided, the other star disappeared normally" (1898 August 23).
β 709.	"The first and brighter star glided" (1898 December 18).
P. III. 128.	"Some light seemed to disappear some 2 or 3 secs. before the occultation" (1901 January 28).
Arg. + 21°, 526.	"Glided" (Marked "dpl. ?" in *A.G.C.*) (1900 March 6).
δ Scorpii.	"Glided, took $0{\cdot}4^{\mathrm{s}}$ to disappear" (1899 July 18).
P. XI. 77.	"Glided, $0{\cdot}3^{\mathrm{s}}$, greater part of light disappeared suddenly" (1899 May 19).
132 *Tauri.*	"Disappeared in two portions $0{\cdot}1^{\mathrm{s}}$ between, very good observation" (1899 May 12).

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A considerable number of the double stars disclosed by occultations will be too close to be confirmed by the telescope, and will therefore form a class intermediate to the visual double and the spectroscopic binary.

The occultations of any spectroscopic binaries within the zodiac should be watched for and widely observed.

A series of occultations of *α Virginis* is now commencing. As *α Virginis* is a well-known spectroscopic binary, these occultations demand special attention.

A point in favour of occultations is that they can be observed very well indeed with telescopes of moderate size.

On some future occasion it is purposed to make a collection of all occultations of the above classes that have been recorded.

Cape of Good Hope: 1901 March 5.

Meteoric Showers from the Region of α–β Persei and η Aurigæ.

By W. F. Denning.

A very brilliant meteor was observed at various places in the south of England on 1901 March 6, $7^{h}\ 25^{m}$. Descriptions of its appearance and path have been received from Denmead, Hants; Clapham Common, London, and Epsom Common; Isle of Wight; Lewes, Torquay, Yeovil, &c. Several of the observers give the direction of flight as straight from *Nova Persei*, and there is no doubt that the radiant point was at or closely contiguous to $51°+43°$. There is a well-known, long-enduring shower from about 2° W. of this point, and it forms No. XLIII. in the "General Catalogue of Radiants" (*Memoirs R.A.S.*, vol. liii.). At Denmead, Hants, the meteor as it passed under *Orion's* belt appeared like a ball of fire, and from it three small fragments were detached, one being greenish and two, close together, bright red. At Lewes the meteor is described as being magnificently brilliant and of a greenish colour. "It emerged midway between the *Pleiades* and constellation *Perseus*, and after describing a parabola towards the W. it disappeared, leaving a fiery train in its wake." Miss L. M. Milner, of Torquay, says the meteor was directed straight from the new star and fell towards E. through the constellations of *Lynx* and *Leo*. It was orange colour at first, but developed into a brilliant green; then burst into separate green particles and died out. At Yeovil the meteor was seen in *Gemini*, and passed almost vertically downwards. A comparison of the various observations shows that the object fell from about eighty-four to twenty-seven miles above the English Channel fifteen miles south of St. Alban's Head, Dorset, and